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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

ED 063419

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

IRONWORKER, SHOP
(ship & boat bldg. & rep.; struct. & ornam. metal work)
4-84.610

B-512 5-235

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U. S. Employment Service
in Cooperation with
Iowa State Employment Service

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4-84.610

B-512

Summary

The General Aptitude Test Battery, B-1002A, was administered to a final sample of 51 male applicants who were later employed as Ironworker, Shop 4-84.610 at Pittsburgh-Des Moines Steel Company, Des Moines, Iowa. The criterion consisted of supervisory ratings. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data, and their combined selective efficiency, aptitudes S-Spatial Aptitude, P-Form Perception, F-Finger Dexterity and M-Manual Dexterity were selected for inclusion in the final test norms.

GATB Norms for Ironworker, Shop (ship & boat bldg. & rep.; struct. & ornam. metal work) 4-84.610.

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
S	CB-1- F CB-1- H	95	S	Part 3	90
P	CB-1- A CB-1- L	70	P	Part 5 Part 7	70
F	CB-1- O CB-1- P	75	F	Part 11 Part 12	70
M	CB-1- M CB-1- N	90	M	Part 9 Part 10	85

Effectiveness of Norms

The data in Table IV indicate that 14 of the 18 poor workers, or 78 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 78 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 26 of the 30 workers who made qualifying test scores, or 87 percent, were good workers.

TECHNICAL REPORT

I. Purpose

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Ironworker, Shop 4-84.610

II. Sample

The GATB, B-1002A, was administered during the period December 1, 1959 through June 15, 1960 to 56 male applicants who were later employed as Ironworker, Shop 4-84.610 at Pittsburgh-Des Moines Steel Company, Des Moines, Iowa. Applicants were recruited through the local office of the Iowa State Employment Service. The test scores were not considered in the selection and referral process. Of the 56 applicants tested and hired, 5 were eliminated from the sample: two because they had previous experience, one who was transferred to another plant, one who was transferred to an office position, and one who left to join the armed forces. Therefore, the final sample consisted of 51 men. The company requires that all applicants weigh at least 160 pounds, pass a company physical, complete an application form, and have an oral interview. There are no age or educational requirements, however, the company prefers applicants, age 18 to 40, who have completed at least the 10th or 11th grade. All new workers were placed on the job as helpers. Some formal training is given by foreman and supervisors. This includes such subjects as blueprint reading and heating characteristics of steel. As the workers progressed on the job and acquired additional skills, they were given increasingly difficult tasks to perform. At the end of 6 months on the job, the workers are usually sufficiently skilled to handle most assignments. All of the workers in the experimental sample had completed at least 6 months on the job and had an equal opportunity to develop their skill.

TABLE I

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

N = 51	M	σ	Range	r
Age (years)	22.6	4.9	18-38	-.082
Education (years)	10.5	1.5	6-13	.204
Experience (months)	7.6	1.2	6-10	-.110

III. Job Description

Job Title: Ironworker, Shop (ship & boat bldg. & rep.; struct. & ornam. metal work) 4-84.610.

Job Summary: Fabricates or assists in the fabrication of such structural steel assemblies as bridge girders and trusses, water towers and other tanks, special structures, and other items including girders, plates and columns for building construction.

Work Performed. Reviews blueprints, sketches, drawings and other instructions and plans work under the supervision of a foreman. Obtains jigs, fixtures, clamps and other support forms. Obtains or requests the steel plates, sheets and/or rods needed for the particular job. Moves and positions material by hand or electric hoist or by directing overhead crane. Studies blueprints to determine how the parts are to be assembled, or receives instructions from foreman. Determines the lengths, widths, and shapes that need to be cut from the steel plates, rods, and sheets. Marks places where stock is to be cut using a punch, scriber, file, or chalk. Marks locations for centers of holes to be drilled using center punch. Cuts steel plates, sheets, and rods to size or pattern with a power shear or an acetylene torch. Operates or directs operation of hand guided or automatic flamecutting machine to cut steel plate into various shapes. Works with tolerances of 1/16" to 1/32". Sets up hydraulic bulldozer machine and cambering press for each job by selecting and correctly placing blocks and dies.

Bends bars, plates, and structural shapes to various curves and angles and narrows plates using bulldozer machine. Operates hand or foot lever to apply pressure. Cambers beams using hydraulic cambering press. Crimps ends of rolled plates for fitting and welding into tubular columns using rotary crimping roller. Trues up structural shapes and assemblies distorted by punching, burning or welding using a hydraulic bulldozer machine. Positions and clamps the material in jigs or forms or props it with blocks and wedges to maintain it in position for assembly. Chips, scrapes, and files the parts to insure that they fit and function correctly. Tack welds, burns, heats, reams, chips and grinds as required in fitting the parts together. Checks work with rule, square, tape, chalk line, templates and straightedge.

Assembles normal run of jobs such as bridge lay downs, tank bottoms and structural assemblies to check fit and operation. Dismantles some completed and checked structural assemblies. Using spray gun or brush, may paint numbers or instructions on assemblies.

IV. Experimental Battery

All the tests of the GATB, B-1002A, were administered to the sample group.

V. Criterion

Criterion data was initially collected on September 9, October 12, and December 13, 1960. The criterion consisted of supervisory ratings based on USES Form SP-21, "Descriptive Rating Scale." Five shop foreman prepared ratings for each worker that they supervised. Reratings were prepared two weeks later by 4 of the 5 foreman. A Pearson-product-moment correlation coefficient of .943 was obtained between the two sets of ratings that were obtained on the 38 individuals who were rerated. One foreman was given a promotion to another plant and began a vacation before starting his new assignment. He left shortly after preparing the initial ratings and was not again available to complete the ratings. Because of this, the initial ratings were chosen as the final criterion. The rating scale that was used consisted of 9 items covering different aspects of job performance with five alternatives for each item. Each of the 5 alternatives were assigned weights ranging from 1 to 5. The possible range of scores was 9 through 45. The actual range of scores was 20 through 39 with a mean score of 29.294 and a standard deviation of 4.811.

VI. Qualitative and Quantitative Analyses

A. Qualitative Analysis:

The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation.

Intelligence (G) - required to exercise independent judgment in planning own work, developing jigs, and fitting structural steel assemblies; to learn the physical properties of steel and understand its reaction under heat and pressure; and to apply knowledge in the operation of various equipment used to cut, ream, heat, weld, and drill steel.

Spatial Aptitude (S) - required to visualize completed structural steel assemblies by reviewing blueprints, sketches, and drawings; to select and/or develop the proper forms and jigs needed to hold each assembly for fitting; and to understand and follow the correct sequence in fitting assemblies.

Form Perception (P) - required to determine proper lengths, widths, and shapes that need to be cut from stock; to properly mark material for shearing, bending, punching, drilling and grinding; to detect warps and other distortions caused by heating, drilling and shaping; and to inspect completed structures and check them for proper operation.

Manual Dexterity (M) - required to build structural steel assemblies; to move and position material by hand or electric hoist; to operate shears, presses, drills and grinders and hand guided flame-cutting machines; to manually chip, scrape and file parts; and to assemble and dismantle completed structural assemblies such as highway and railroad bridges.

On the basis of the job analysis data, V-Verbal Aptitude and Q-Clerical Perception were rated "irrelevant" for successfully performing the duties of this job.

B. Quantitative Analysis:

TABLE II

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N =51

Aptitudes	M	σ	r
G-Intelligence	96.2	13.3	.350*
V-Verbal Aptitude	92.0	12.0	.170
N-Numerical Aptitude	93.2	15.5	.422**
S-Spatial Aptitude	99.4	14.5	.305*
P-Form Perception	95.8	15.9	.471**
Q-Clerical Perception	93.3	13.1	.421**
K-Motor Coordination	90.3	17.4	.324*
F-Finger Dexterity	92.4	16.5	.358*
M-Manual Dexterity	96.1	18.3	.441**

**Significant at the .01 level
*Significant at the .05 level

C. Selection of Test Norms:

TABLE III

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X			X	X				X
Irrelevant		X				X			
Relatively High Mean	X			X	X				X
Relatively Low Sigma	X	X		X		X			
Significant Correlation with Criterion	X		X	X	X	X	X	X	X
Aptitudes to be Considered for Trial Norms	G		N	S	P		K	F	M

Trial norms consisting of various combinations of Aptitudes G,N,S,P,K,F and M with appropriate cutting scores were evaluated against the criterion by means of the Phi Coefficient technique. A comparison of the results showed that B-1002 norms consisting of S-90, P-70, F-70 and M-85 had the best selective efficiency.

VII. Validity of Norms (Concurrent)

The validity of the norms was determined by computing a Phi Coefficient between the test norms and the criterion and applying the Chi Square test. The criterion was dichotomized by placing 35 percent of the sample in the low criterion group because this percent was considered to be the unsatisfactory or marginal workers.

Table IV shows the relationship between test norms consisting of Aptitudes S, P, F and M with critical scores of 90, 70, 70 and 85, respectively, and the dichotomized criterion for Ironworker, Shop 4-84.610. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Validity of Test Norms for Ironworker, Shop 4-84.610
(S-90, P-70, F-70, M-85)

N = 51	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	7	26	33
Poor Workers	14	4	18
Total	21	30	51

Phi Coefficient = .55
χ^2 = 15.371
P/2 < .0005

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of the results of this study, Aptitudes S, P, F and M with minimum scores of 90, 70, 70 and 85, respectively, have been established as B-1002 norms for Ironworker, Shop 4-84.610. The equivalent B-1001 norms consist of S-95, P-70, F-75 and M-90.

IX. Determination of Occupational Aptitude Pattern

Of the existing 35 OAP's (revised 10/61), a significant relationship between OAP-32 and the criterion for the experimental sample was obtained. The proportion of the sample screened out by OAP-32 was .29, which is within the required range of .10 to .60. Therefore, the occupation Ironworker, Shop 4-84.610 has been incorporated into OAP-32.